Appendix F.2:
High Wind (Hurricane)

Vulnerability Assessment Parameters, Methodology and Results

The hurricane wind hazard vulnerability assessment of State-owned buildings and critical facilities in Louisiana involved an analysis of the parameters described below.

- Design Wind Speed: The design wind speed was determined based on American Society of Civil Engineers (ASCE) Standard 7-02, *Minimum Design Loads for Buildings and Other Structures*. ASCE 7-02 is the basis for wind design in the new International Building Code (IBC), and has been available as an alternate basis for wind design under the old Standard Building Code (SBC). The minimum design wind speeds in ASCE 7-02 are based on the maximum 3-second peak wind gust speeds recorded over a 100-year recurrence interval in coastal areas and a 50-year recurrence interval in inland areas. The design wind speed zones from ASCE 7-02 for Louisiana are represented graphically on Map 4-6, Hazard Profile – High Wind (Hurricane). Note that the ASCE 7-02 design wind speed map was derived from a variety of sources, and accounts for wind decay modeling of various category hurricane events such as those presented in the *State of Louisiana Hazard Mitigation Plan: Hazard Profiles* dated April 18, 2003. Map F-21 indicates the location of State-owned critical facilities in Louisiana in relation to the design wind speed zones.
- Pre-Wind Code vs. Post-Wind Code Construction: Pre-wind code structures are buildings that were constructed in Louisiana prior to the 1991 SBC. The 1991 SBC was the first building code adopted statewide in Louisiana, and provided a standardized method for analyzing and designing for basic hurricane-force wind pressures. Post-wind code structures were built in Louisiana after the 1991 SBC was adopted statewide, and were designed to account for basic hurricane-force wind pressures. In Louisiana, any structures built after 1991 (i.e., 1992 or later) are recognized as post-wind code.

Based on these two parameters, a hazard vulnerability assessment level (low, medium or high) was assigned for each of the State-owned buildings and critical facilities. The three hazard vulnerability levels are summarized in Table F.2-1.

Table F.2-1

Hazard Vulnerability Level	Design Wind Speed (mph)	Pre-Wind Code vs. Post-Wind Code
Low	≤ 90	Post-Wind Code
Low	≤ 90	Pre-Wind Code
Low	91-110	Post-Wind Code
Medium	91-110	Pre-Wind Code
Medium	> 110	Post-Wind Code
High	> 110	Pre-Wind Code

Map F-22 shows State-owned critical facilities by level of vulnerability to the hurricane wind hazard.

Loss Estimate Parameters, Methodology and Results

The hurricane wind loss estimate of State-owned buildings and critical facilities in Louisiana involved an analysis of the parameters described below.

- Hurricane Wind Hazard Vulnerability: As stated on the preceding page, hurricane wind hazard vulnerability assessments involved an analysis of two major parameters: design wind speed and whether the structure was pre-wind code or post-wind code construction. See Table F.2-1 for hurricane wind vulnerability levels.
- Average Building Type: Although the building types for each structure were described in the statewide GIS database, an analysis of all building types for individual State-owned buildings and critical facilities was beyond the scope of this loss estimate. Therefore, in order to conduct basic analyses, individual loss estimates assumed an average building type of a lightly engineered building. This average building type was determined based on experience with typical building construction in Louisiana.
- Hurricane Wind Damage Functions (WDFs): Physical (building) damage, contents damage and LOF costs for each structure were estimated based on a series of WDFs. These WDFs were developed based on damage functions for FEMA's *Full Data Benefit-Cost Module for Hurricane Wind Projects* (version 5.1a dated March 13, 2003). The WDFs for building damage, contents damage and LOF are summarized in the Table F.2-2.

Table F.2-2

Design Wind Speed	Average Building Type	Design Wind Speed (mph)	Building WDF (%BRV)	Contents WDF (%BRV)	LOF (days)
≤ 90 mph	Lightly Engineered (Post-Wind Code)	≤ 90	2.5%	0.6%	2.5
≤ 90 mph	Lightly Engineered (Pre-Wind Code)	≤ 90	5.0%	1.3%	5
91 - 110 mph	Lightly Engineered (Post-Wind Code)	91 - 110	7.5%	3.8%	7.5
91 - 110 mph	Lightly Engineered (Pre-Wind Code)	91 - 110	15.0%	7.5%	15
> 110 mph	Lightly Engineered (Post-Wind Code)	> 110	15.0%	10.0%	15
> 110 mph	Lightly Engineered (Pre-Wind Code)	> 110	30.0%	20.0%	30

NOTE: Assume contents value = 50% BRV

- Physical Damage: Physical damages were estimated as a percentage of the BRV. For each structure, the BRV was determined based on building values obtained from the statewide GIS database. The physical damage costs were computed by multiplying the BRV by the corresponding building WDF.
- Contents Damage: Contents damages were estimated as a percentage of the contents replacement value. For each structure, the contents replacement value was estimated based on a percentage of the BRV determined from the statewide GIS database. Based on an analysis of HAZUS data for various building types, the contents replacement values were equal to an average of 50 percent of the BRVs. The contents damage costs were determined by multiplying the contents replacement value by the corresponding contents WDF (see Table F.2-2).

- LOF: LOF costs were estimated as a proportion of the annual operating budget for each structure. The annual operating budgets for each facility were determined as a proportion of the current annual operating budget for the State of Louisiana. This annual operating budget, currently estimated at approximately $16.0 billion, was distributed to individual State-owned buildings and critical facilities based on the *factored square footage* of each structure. The factored square footage for each structure was determined by multiplying the actual square footage by a CF based on the criticality of each structure. A summary of CFs is provided in Table F.1-2. Note that by applying the CF to the square footage of each structure, it allows higher criticality facilities (such as fire stations) to obtain a larger proportion of the statewide annual budget, thereby increasing their annual budget values and LOF costs to reflect their importance. Once the annual operating budget was obtained for each structure, the LOF costs were computed by dividing the annual operating budget by 365 (to convert the annual budget to a daily budget) and multiplying by the corresponding WDF for LOF (measured in days).

Once these parameters were determined, the combined loss estimate (building, contents, and loss of function) in dollars for each structure was determined using the following formula:

Combined Loss Estimate = (Physical Damage + Contents Damage + LOF)

The critical facilities in Louisiana with the highest physical damage, contents damage and LOF costs for the hurricane wind hazard are presented in Maps F-23, F-24 and F-25 respectively. Map F-26 (also Map 6-5) presents the results of the combined hurricane wind loss estimate computations. The ten critical facilities in Louisiana with the highest combined loss estimates for the hurricane wind hazard are shown on Map F-27 (also Map 6-5) and are summarized in Table 6-9. State-owned critical facilities for each agency in Louisiana with the highest combined loss estimates for the hurricane wind hazard are presented in Maps F-28 thru F-43.

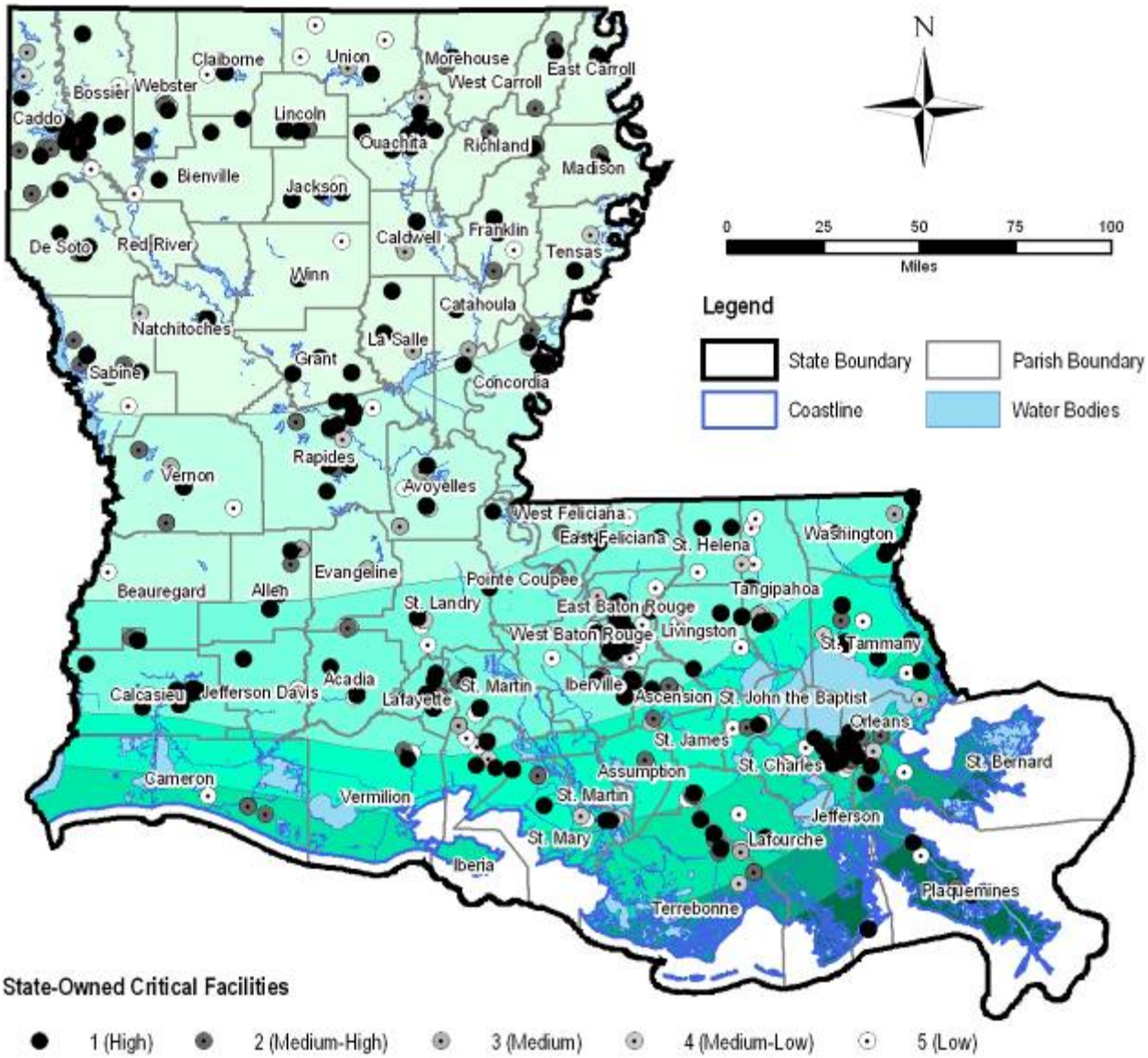
List of Assumptions

The hurricane wind loss estimate is based on the following assumptions.

- General: Hurricane wind loss estimates for individual structures are based on the 100-year wind event in coastal areas and the 50-year wind event further inland. Note that the assigning of numerical values and factors for loss estimate parameters is often qualitative in nature and based on data from a number of sources with varying degrees of accuracy. For this reason, hurricane wind loss estimates for individual structures should not be used for estimating property insurance coverage or other needs that require a high degree of accuracy.
- Hurricane Wind Hazard Vulnerability: Structures located in the 90-mph wind zone will experience wind damages associated with Category 1 hurricane winds. Structures located in the 100- and 110-mph wind zones will experience wind damages associated with Category 2 hurricane winds. Structures located in the 120-mph wind zone will experience wind damages associated with Category 3 hurricane winds.
- Average Building Type and Hurricane WDFs: The physical and contents damages to individual State-owned buildings and critical facilities from hurricane wind will be considered the same as lightly engineered buildings. Structures of this building type may combine masonry, light steel framing, open-web steel joists, wood framing, and wood rafters. Some portions of lightly engineered buildings have received engineering attention while others have not. WDFs for pre-wind code structures were taken directly from FEMA's *Full Data Benefit-Cost Module for Hurricane Wind Projects* (version 5.1a dated March 13, 2003). WDFs for post-wind code structures were reduced by 50 percent from the pre-wind code structures to account for the wind mitigation benefits derived from newer, code-compliant design. In the event the statewide GIS database did not provide a construction date for an individual structure, the structure was considered to be pre-wind code.
- Physical Damage: For each structure, the BRV is consistent with the building values obtained from the statewide GIS database. In the event the statewide GIS database did not provide a BRV for an individual structure, the BRV was estimated to be zero.

- Contents Damage: For each structure, the contents replacement value is equal to 50 percent of BRV.
- LOF: The $16.0 billion current annual operating budget for the State of Louisiana is distributed among all State-owned buildings and critical facilities in the statewide GIS database based on the factored square footage of each structure. In the event the statewide GIS database did not provide a square footage and/or criticality level for an individual structure, that square footage and/or criticality level was estimated based on the average square footage and/or criticality level for all structures in the statewide GIS database with available data. The CFs were derived based loosely on FEMA's *What is a Benefit?* draft guidance document dated May 1, 2001 and engineering judgment.

Map F-21: Location of Critical Facilities - High Winds



State-Owned Critical Facilities

1 (High) 2 (Medium-High) 3 (Medium) 4 (Medium-Low) 5 (Low)

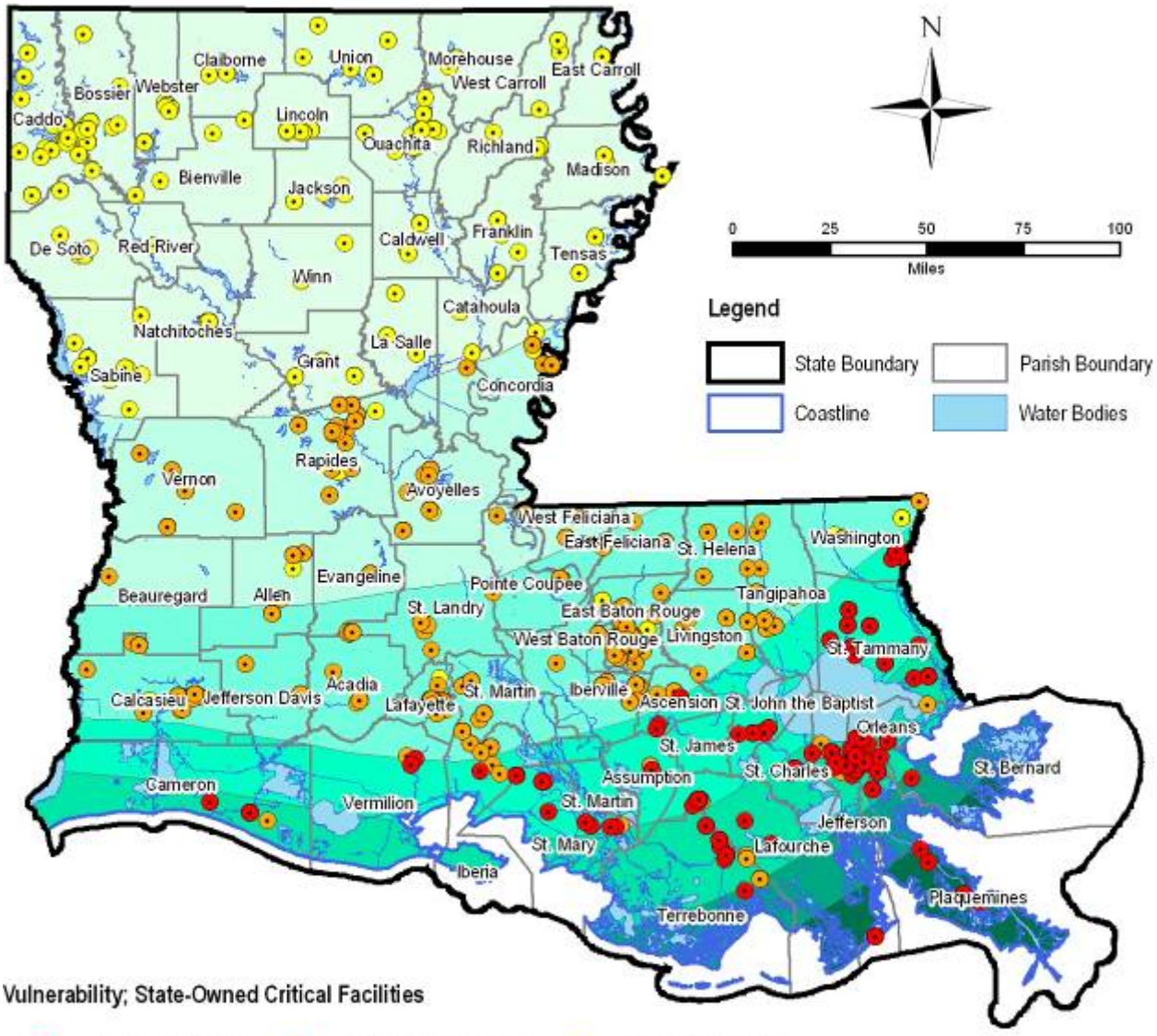
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph
91 - 100 mph
101 - 110 mph
111 - 120 mph
121 - 130 mph
131 - 140 mph
141 - 150 mph

Source: ASCE Standard 7-02

Map F-22: Vulnerability Assessment - High Winds



Vulnerability; State-Owned Critical Facilities

High (12% of Total) Medium (55% of Total) Low (33% of Total)

Source: Louisiana Facility Management Database

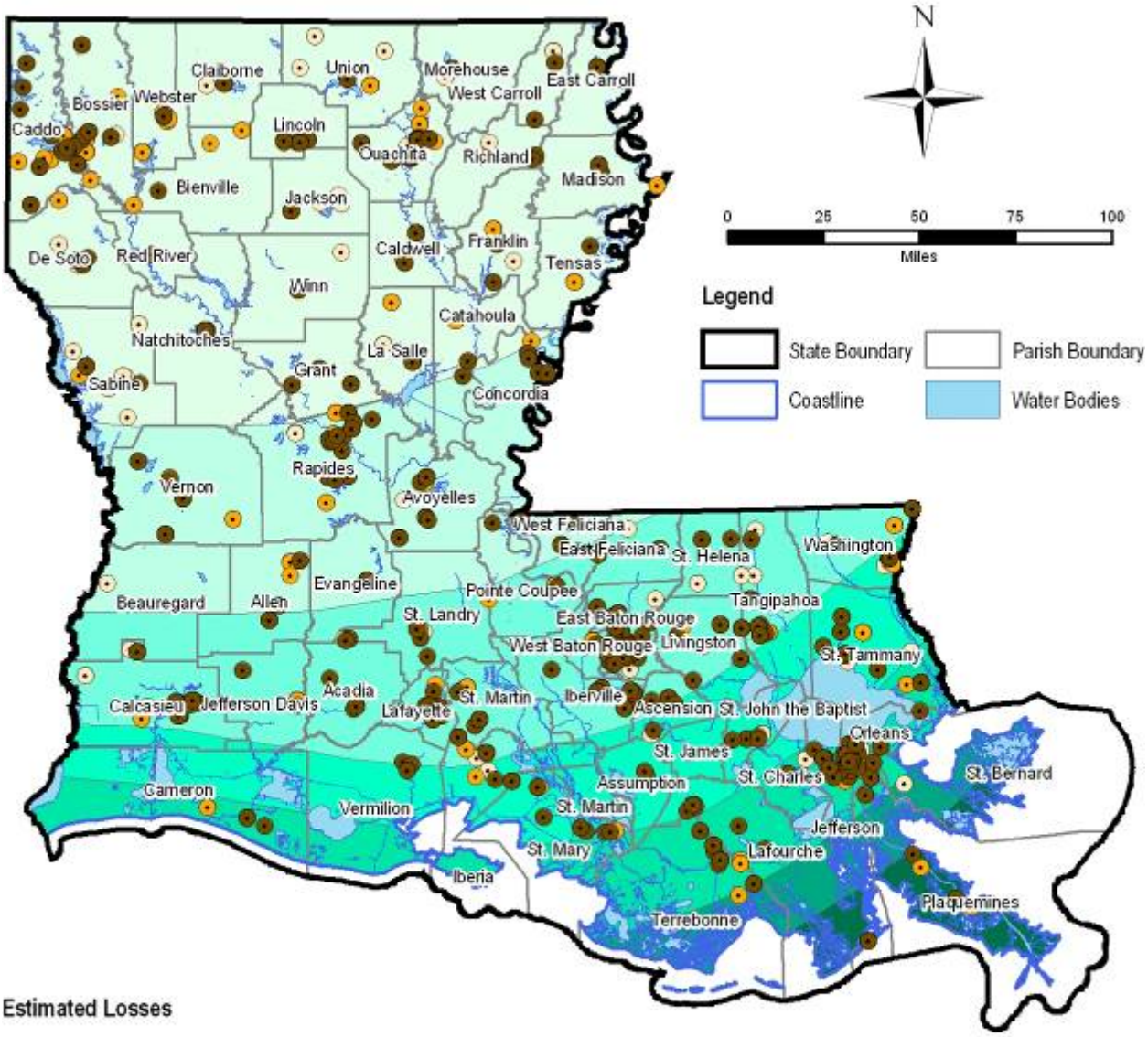
Wind Speed

Less than 90 mph | 101 - 110 mph | 121 - 130 mph | 141 - 150 mph

91 - 100 mph | 111 - 120 mph | 131 - 140 mph

Source: ASCE Standard 7-02

Map F-23: Loss Estimate - High Winds - Physical Damage



Estimated Losses

Low: $0 - $750 Medium: $751 - $6,500 High: $6,501 - $90,000,000

Source: Louisiana Facility Management Database

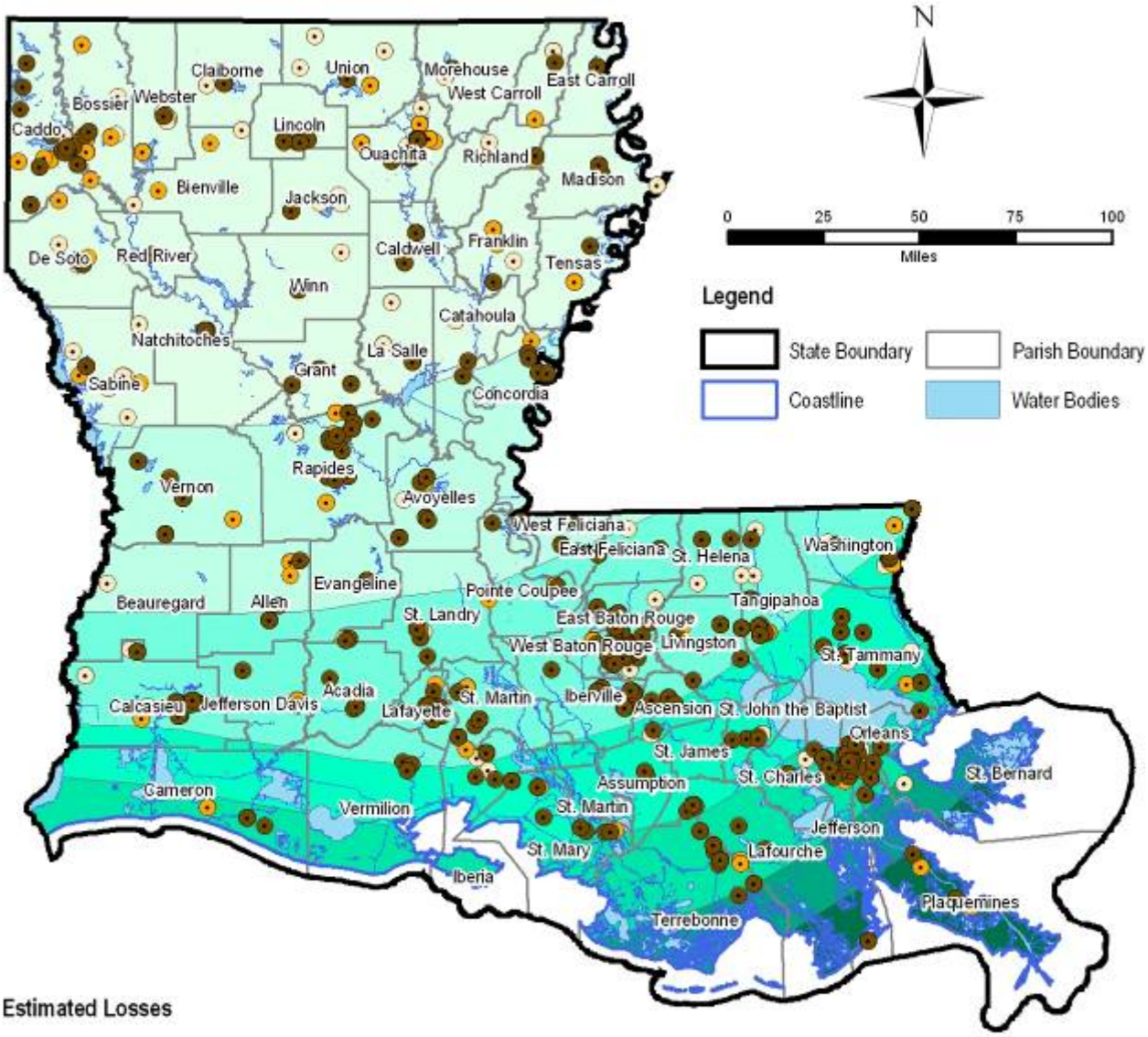
Wind Speed

Less than 90 mph | 101 - 110 mph | 121 - 130 mph | 141 - 150 mph

91 - 100 mph | 111 - 120 mph | 131 - 140 mph

Source: ASCE Standard 7-02

Map F-24: Loss Estimate - High Winds - Contents



Estimated Losses

Low: $0 - $500 Medium: $501 - $3,000 High: $3,001 - $57,500,000

Source: Louisiana Facility Management Database

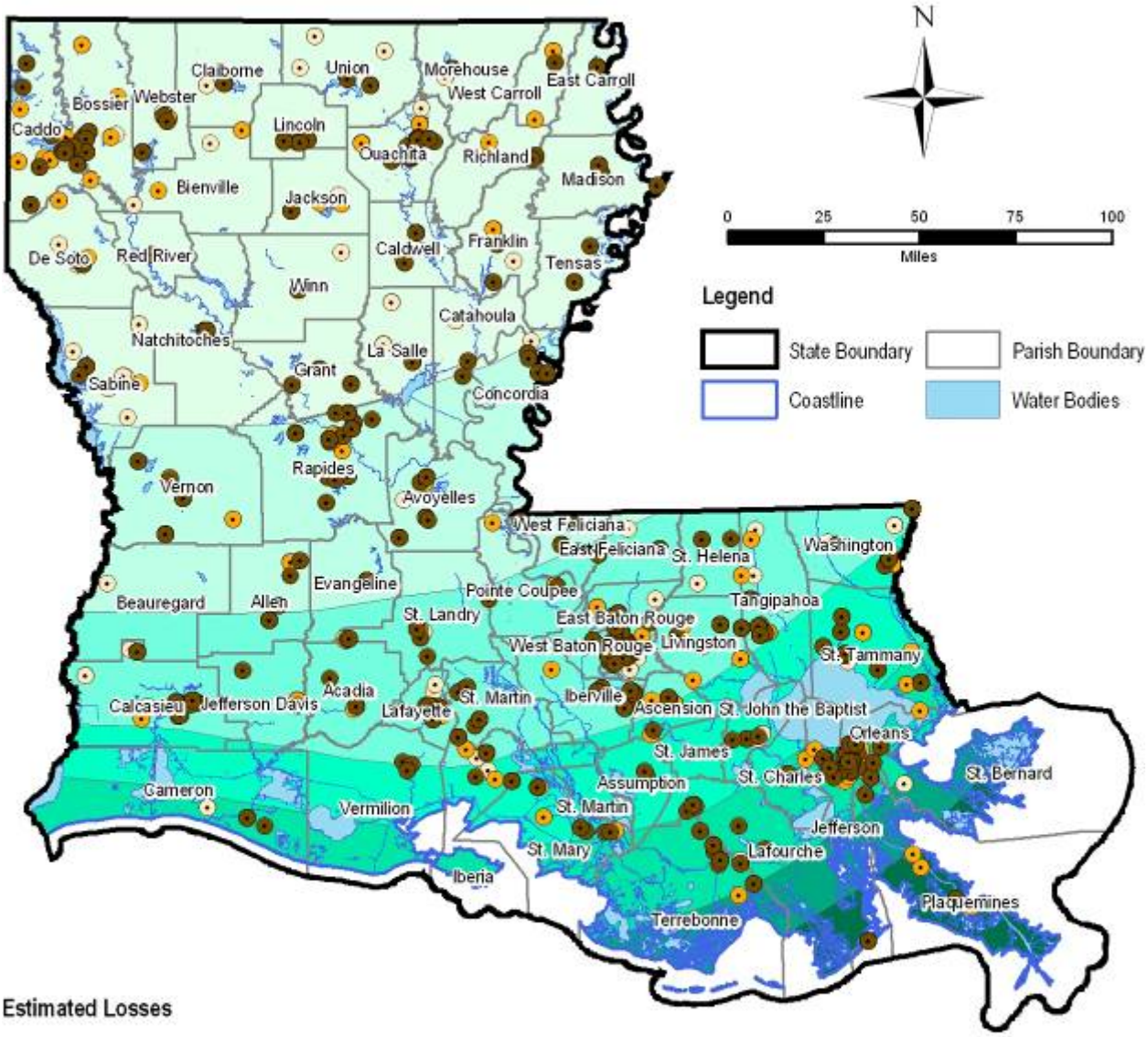
Wind Speed

Less than 90 mph | 101 - 110 mph | 121 - 130 mph | 141 - 150 mph

91 - 100 mph | 111 - 120 mph | 131 - 140 mph

Source: ASCE Standard 7-02

Map F-25: Loss Estimate - High Winds - Function



Estimated Losses

Low: $0 - $2,500 Medium: $2,501 - $15,000 High: $15,001 - $100,750,000

Source: Louisiana Facility Management Database

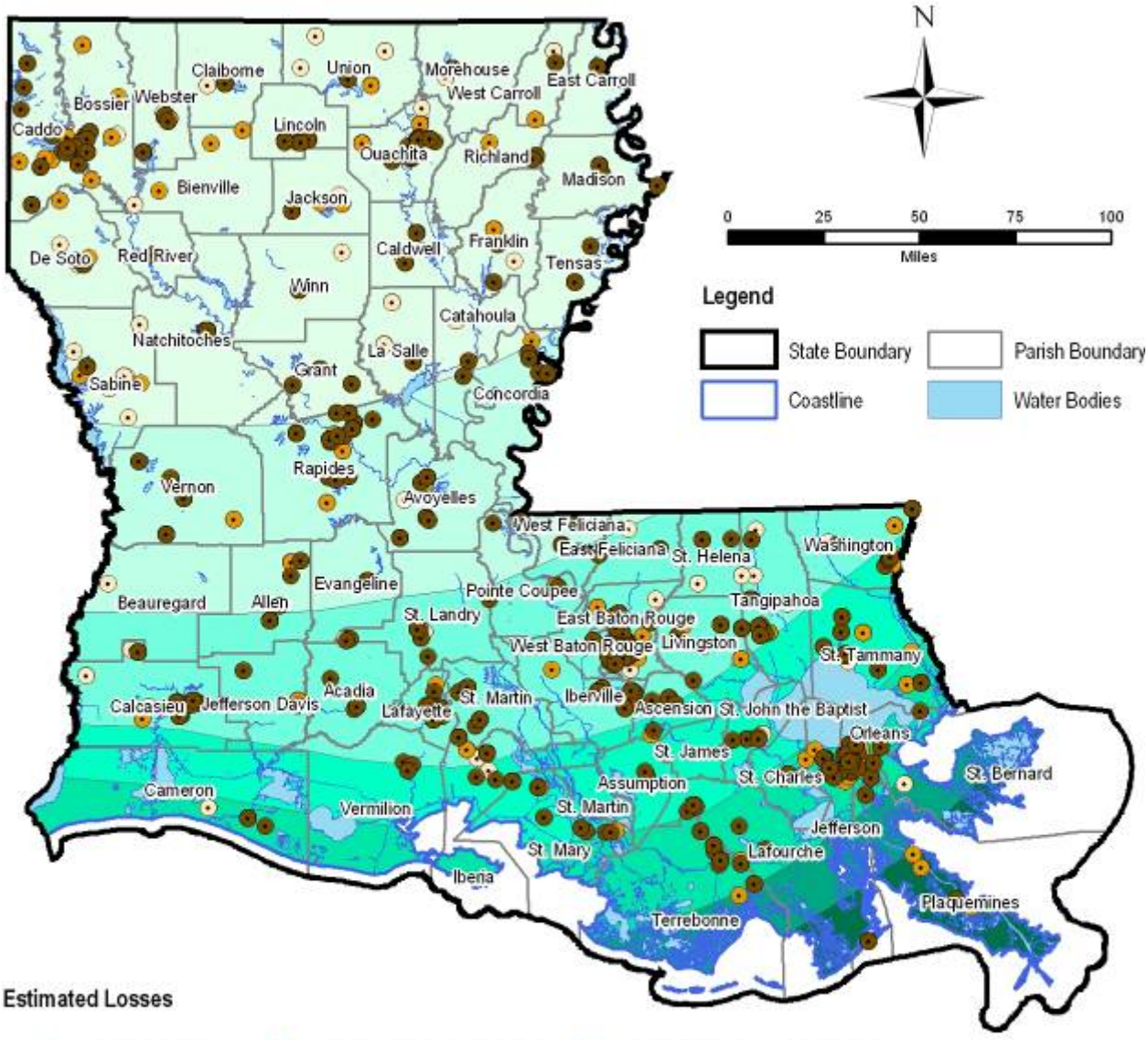
Wind Speed

Less than 90 mph | 101 - 110 mph | 121 - 130 mph | 141 - 150 mph

91 - 100 mph | 111 - 120 mph | 131 - 140 mph

Source: ASCE Standard 7-02

Map F-26: Loss Estimate - High Winds - Total



Estimated Losses

Low: $0 - $4,000 Medium: $4,001 - $30,000 High: $30,001 - $225,000,000

Source: Louisiana Facility Management Database

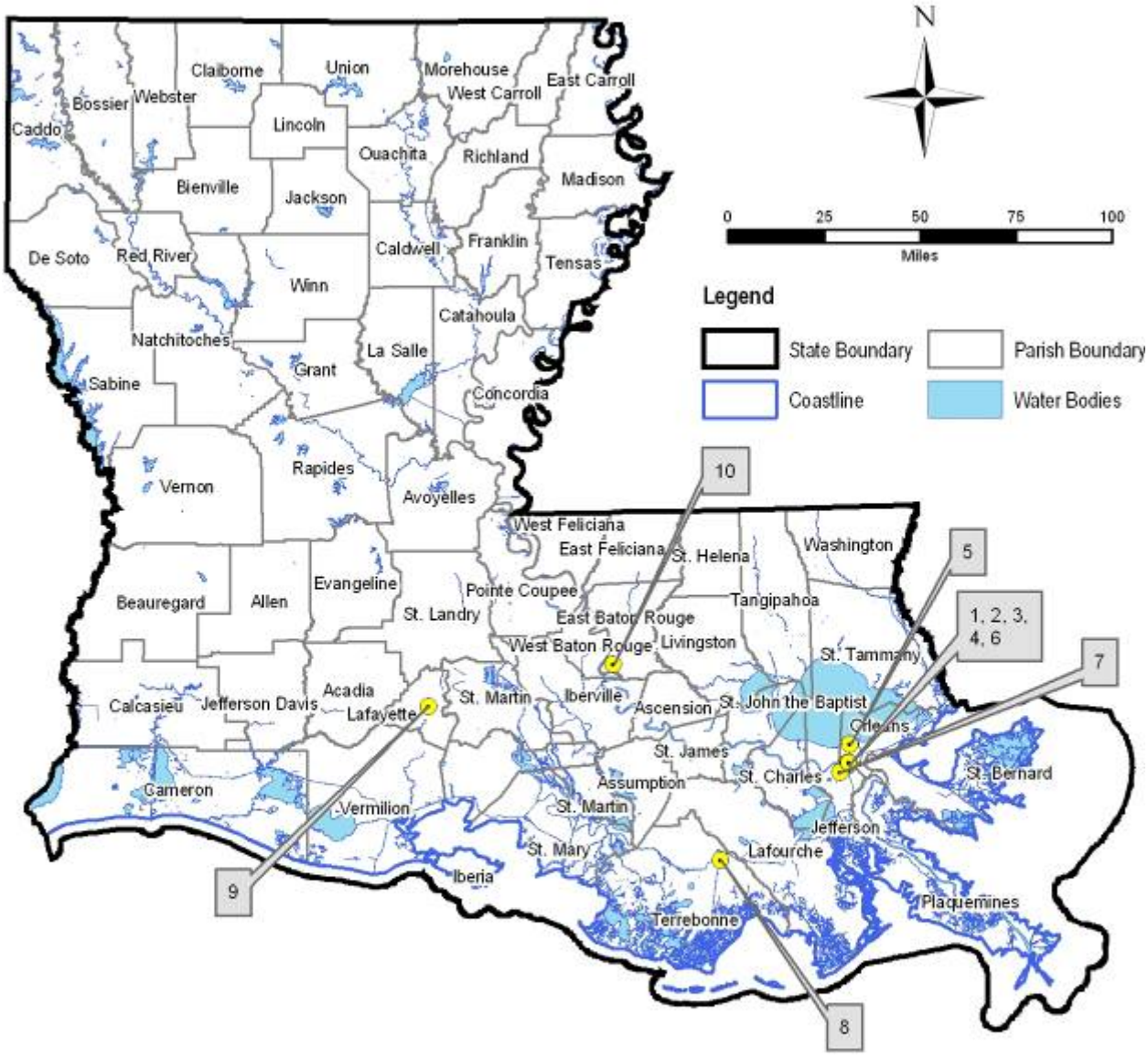
Wind Speed

Less than 90 mph | 101 - 110 mph | 121 - 130 mph | 141 - 150 mph

91 - 100 mph | 111 - 120 mph | 131 - 140 mph

Source: ASCE Standard 7-02

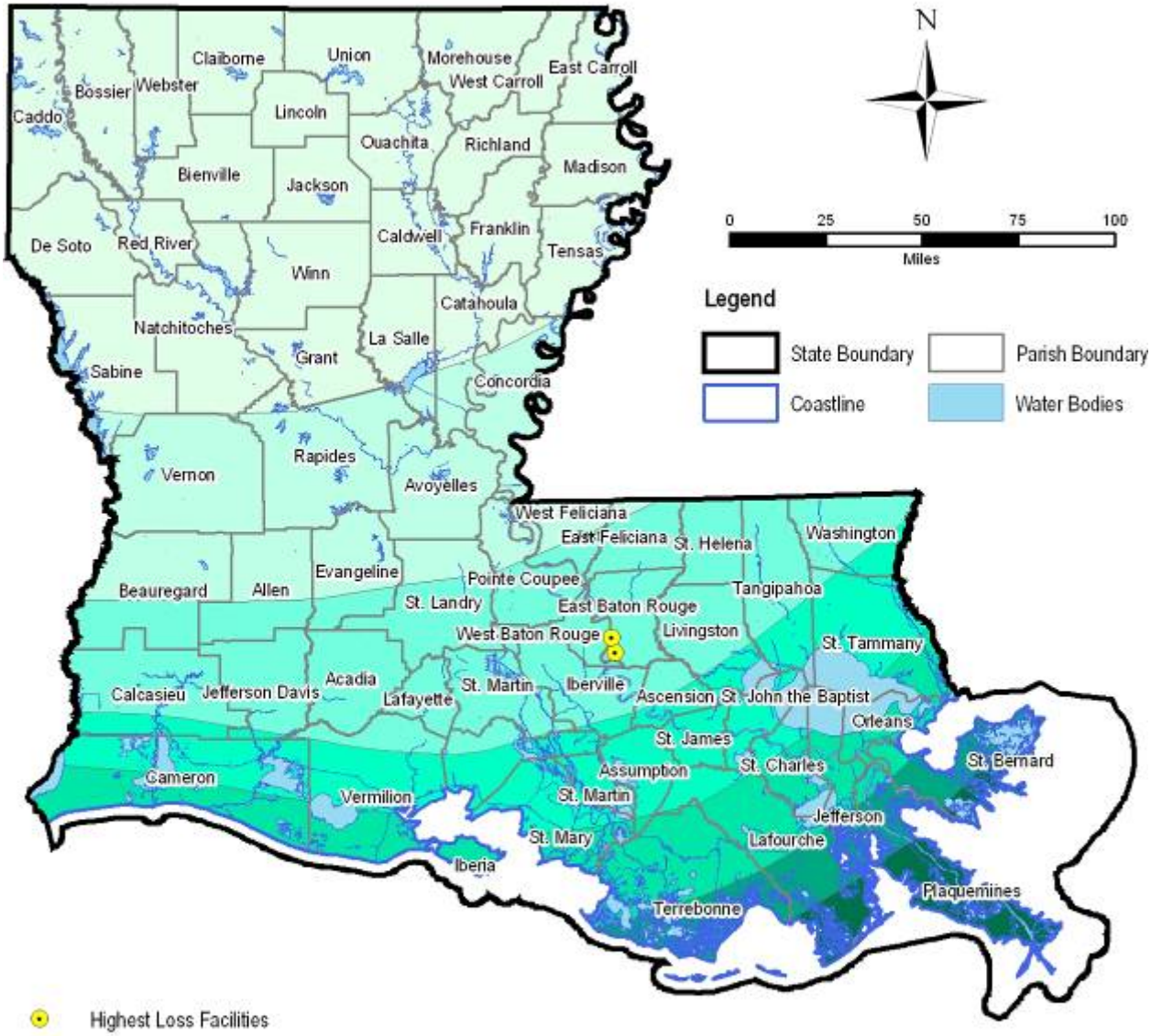
Map F-27: Loss Estimate - High Winds - Top 10



⊙ Highest Loss Facilities

Source: Louisiana Facility Management Database

Map F-28: Loss Estimate - High Winds - Top 10 - Ancillary Funds



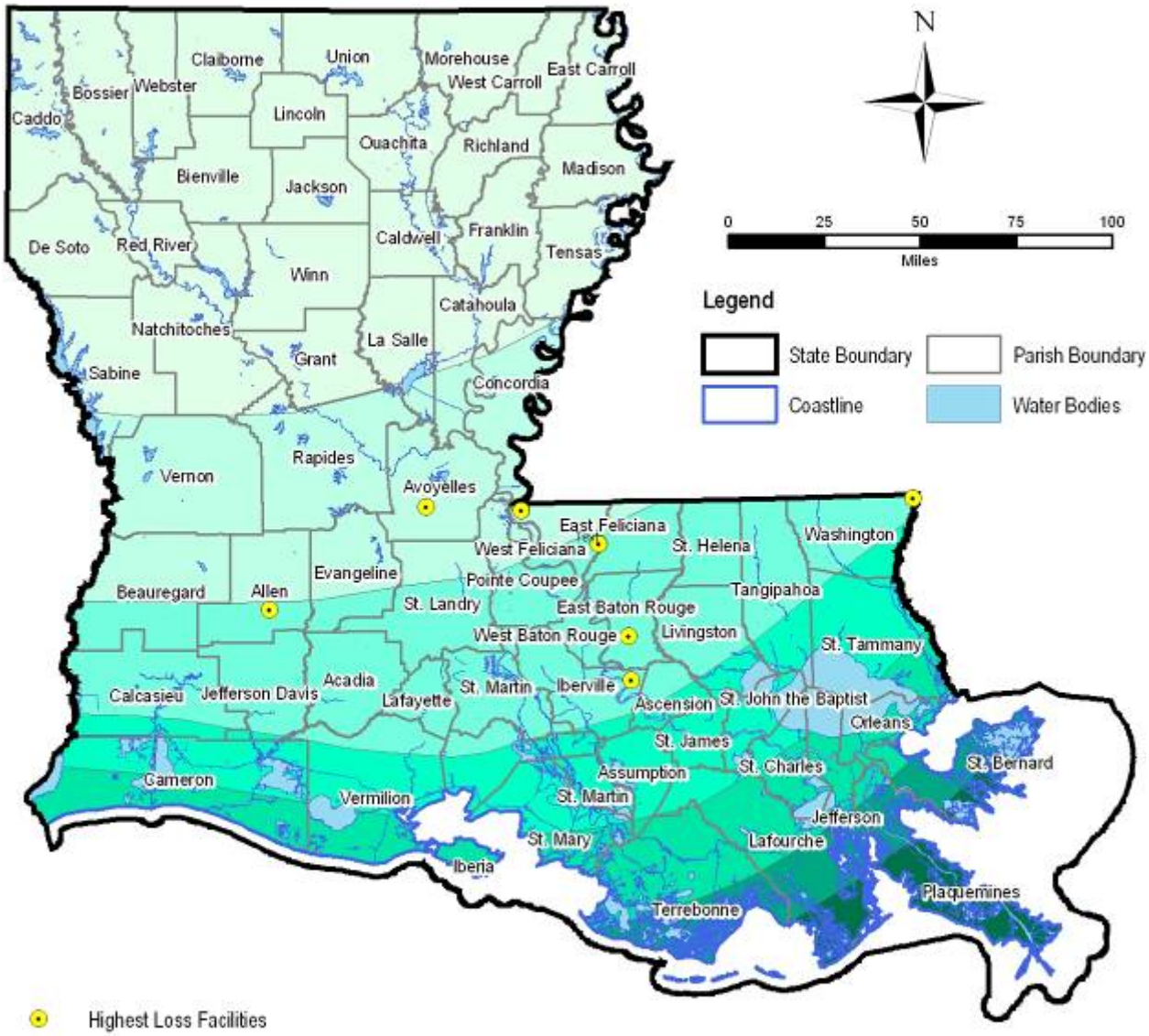
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-29: Loss Estimate - High Winds - Top 10 - Department of Public Safety and Corrections



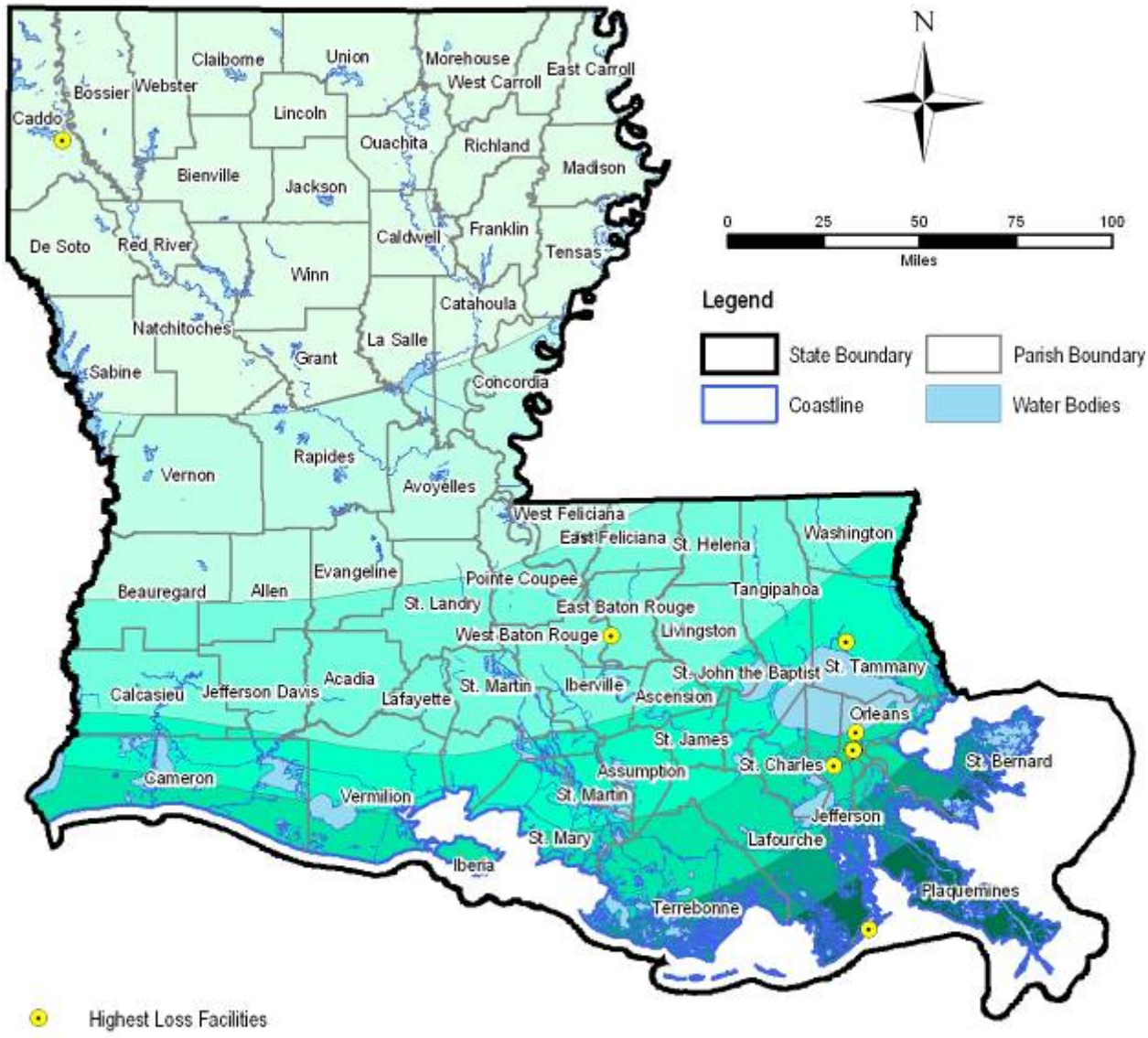
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-30: Loss Estimate - High Winds - Top 10 - Department of Culture, Recreation and Tourism



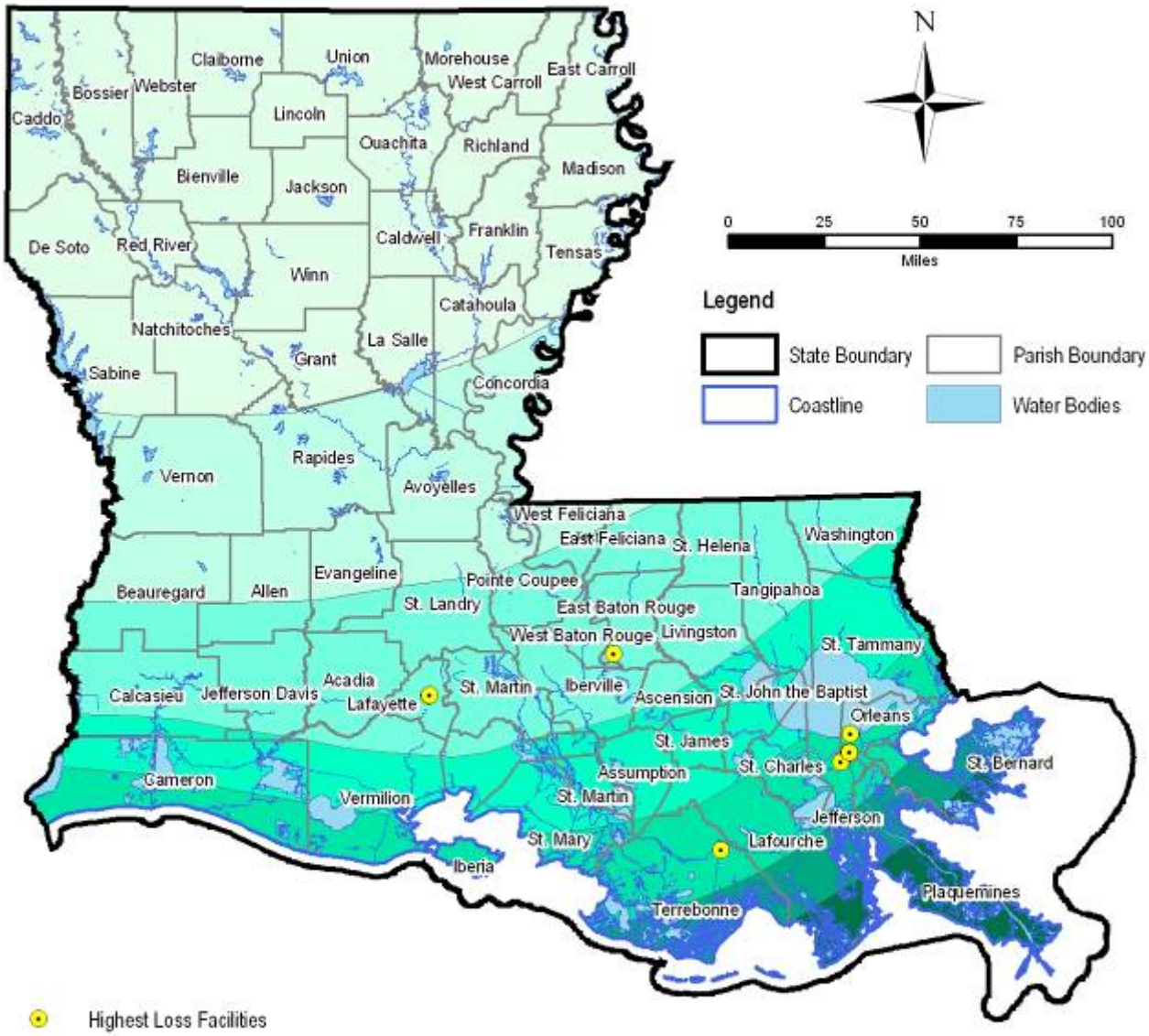
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-31: Loss Estimate - High Winds - Top 10 - Department of Education



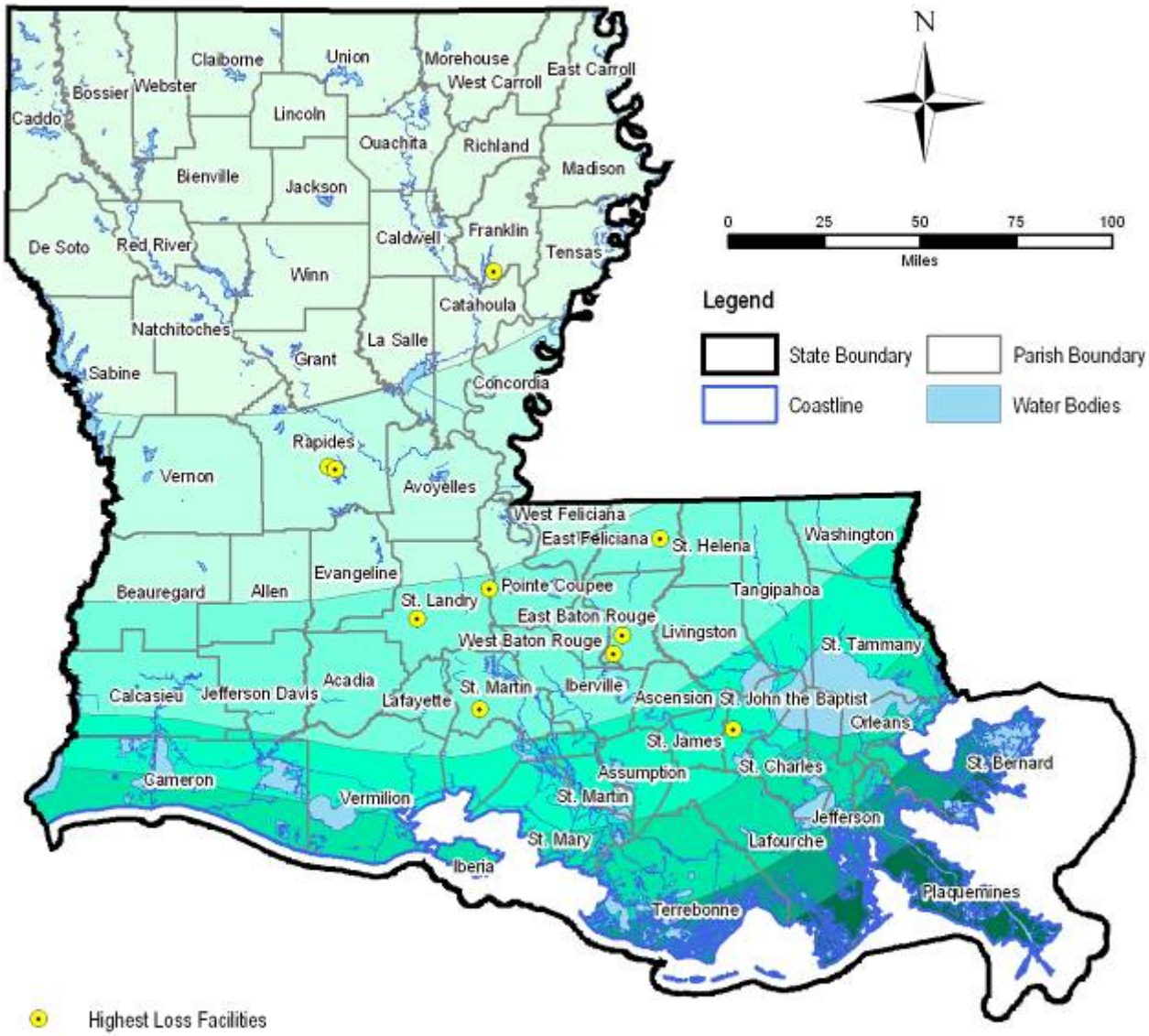
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-32: Loss Estimate - High Winds - Top 10 - Elected Officials



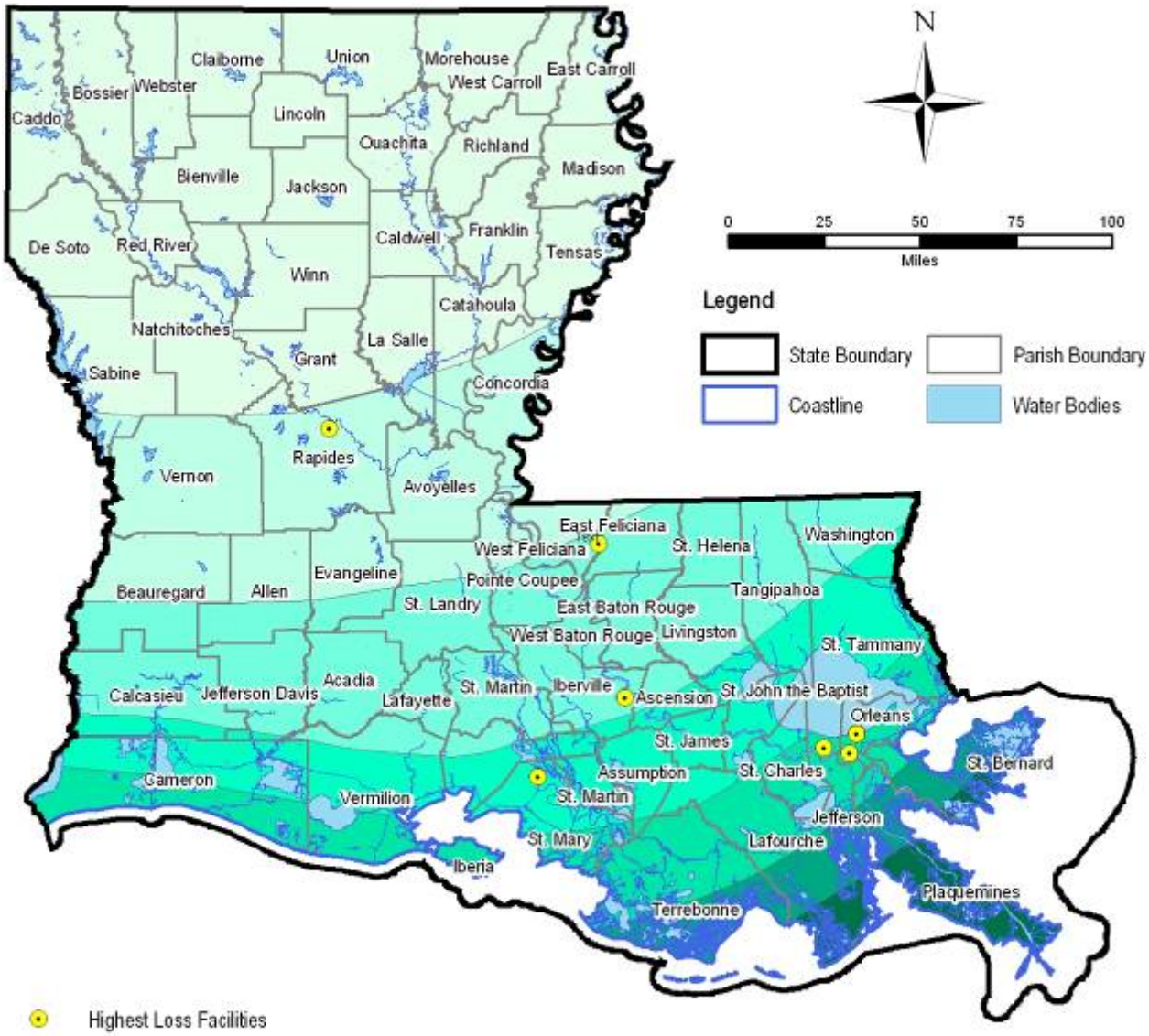
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-33: Loss Estimate - High Winds - Top 10 - Executive Department



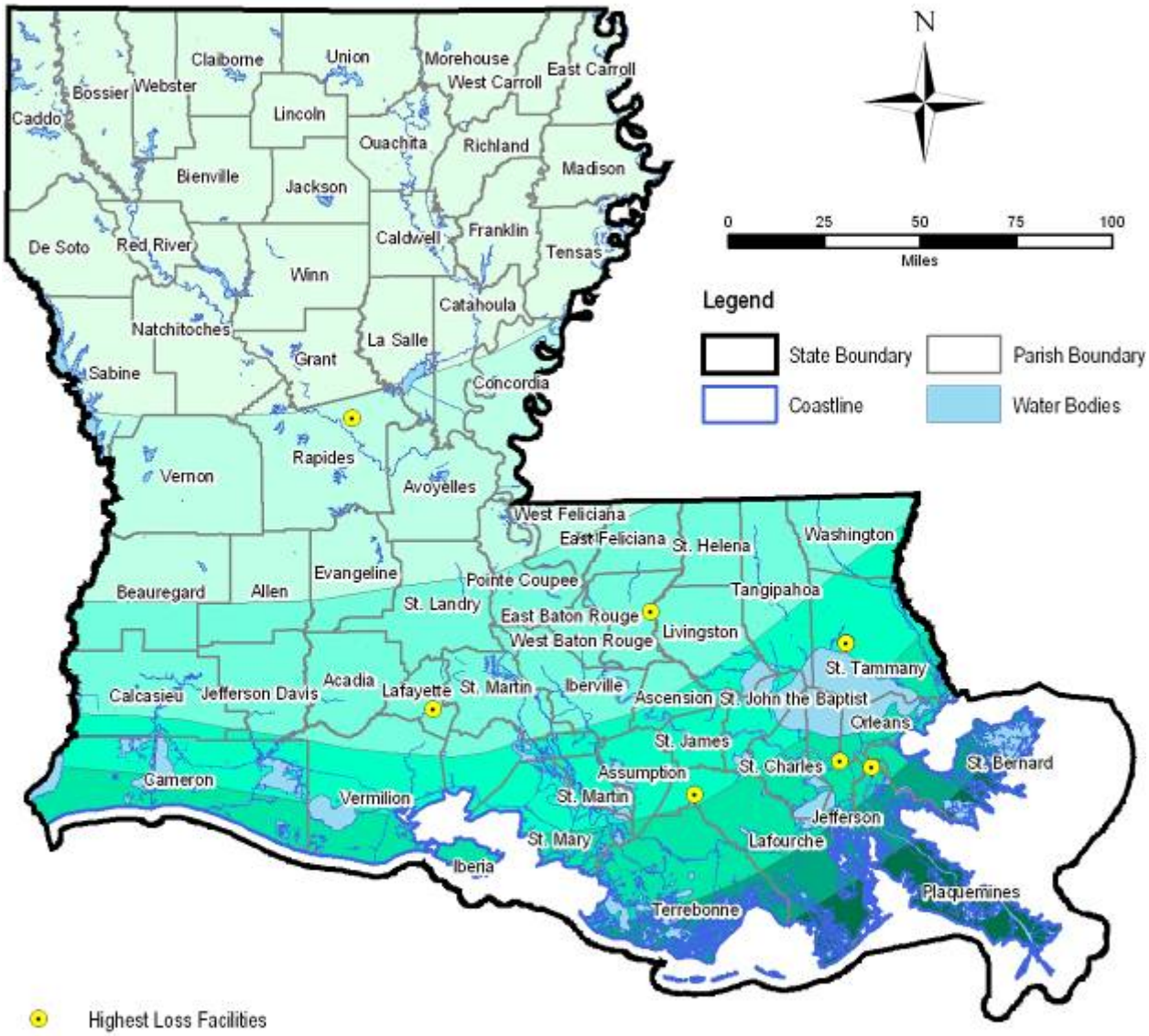
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-34: Loss Estimate - High Winds - Top 10 - Department of Health and Hospitals



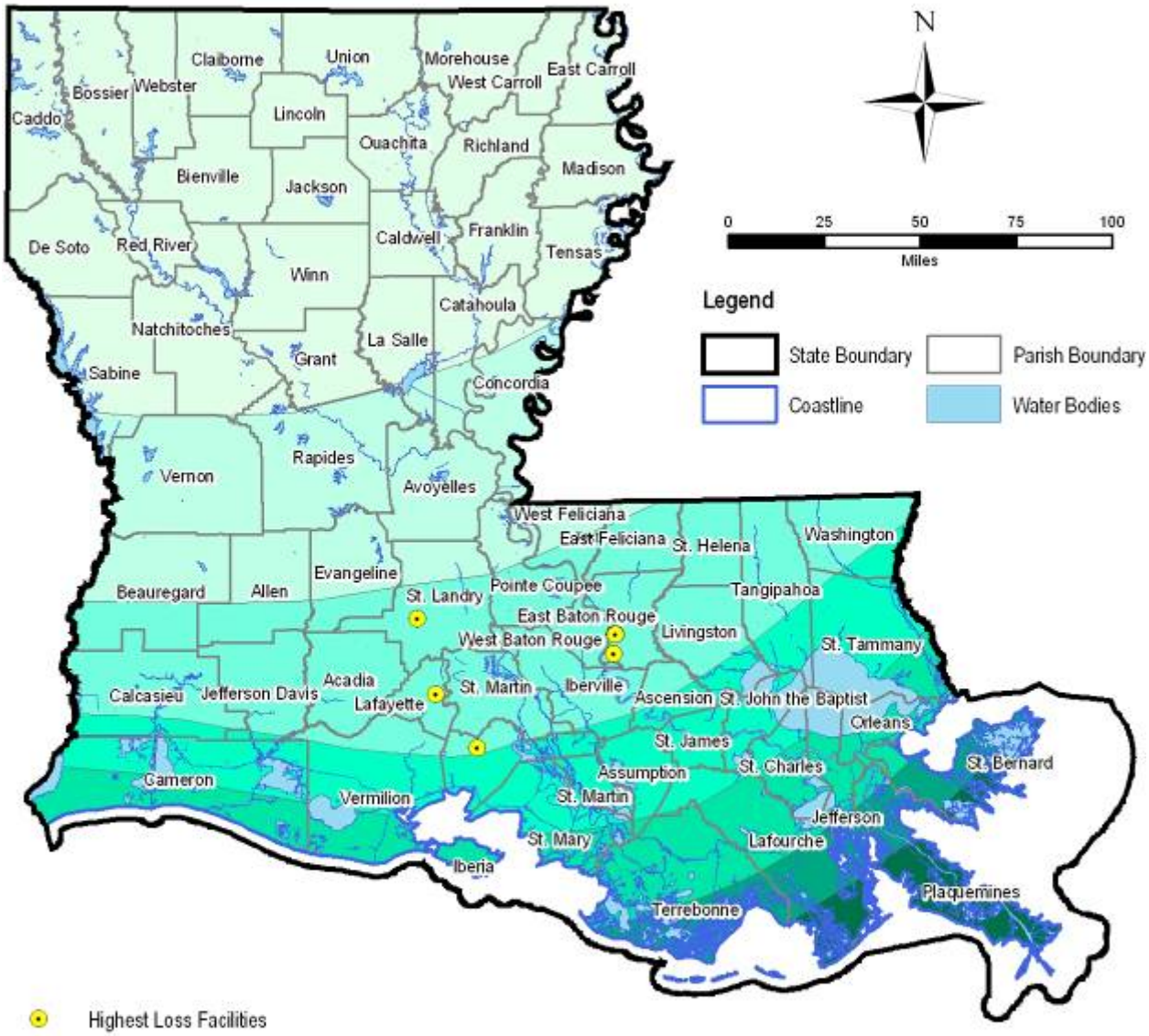
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-35: Loss Estimate - High Winds - Top 10 - Department of Labor



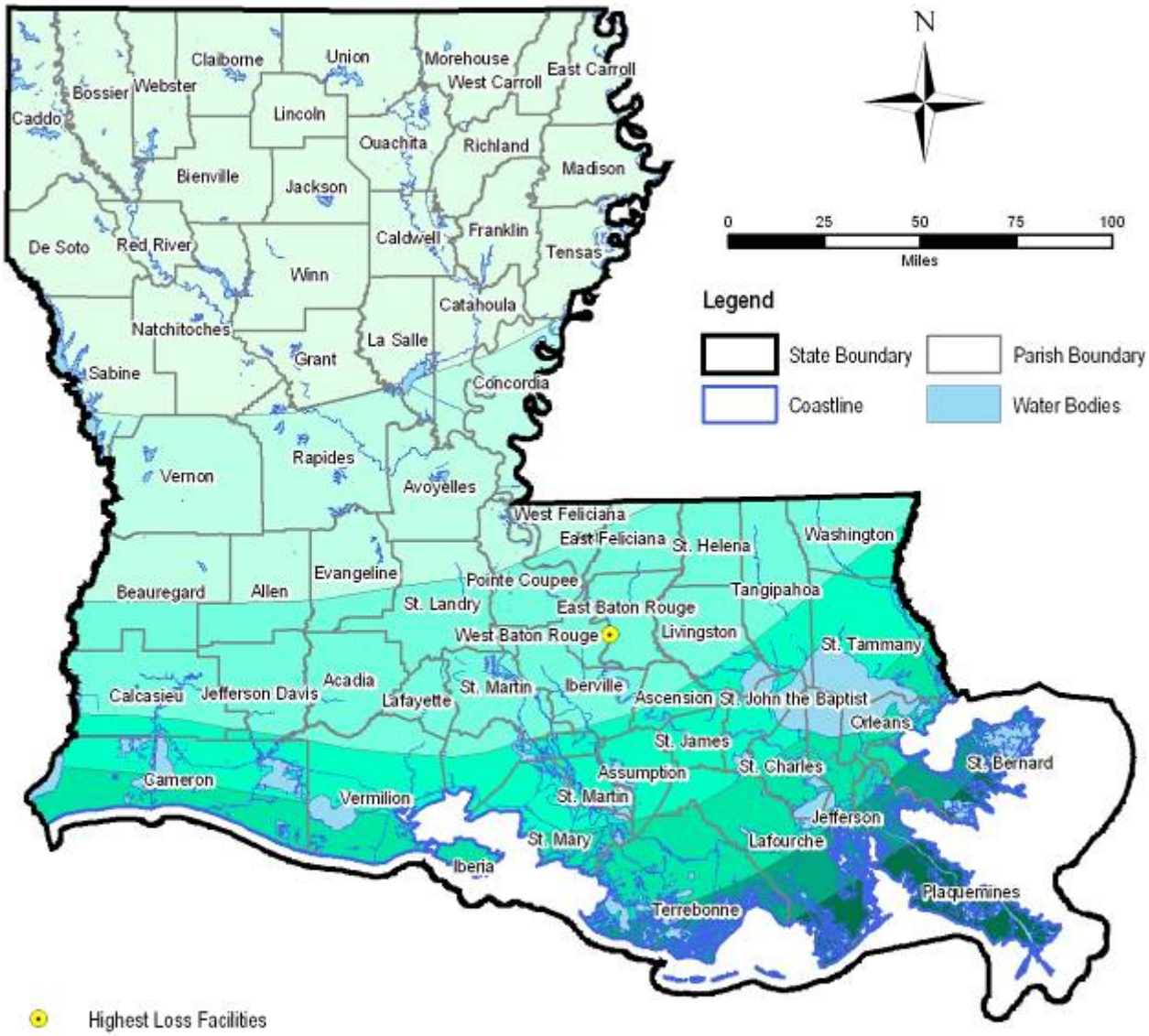
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-36: Loss Estimate - High Winds - Top 10 - Legislative Department



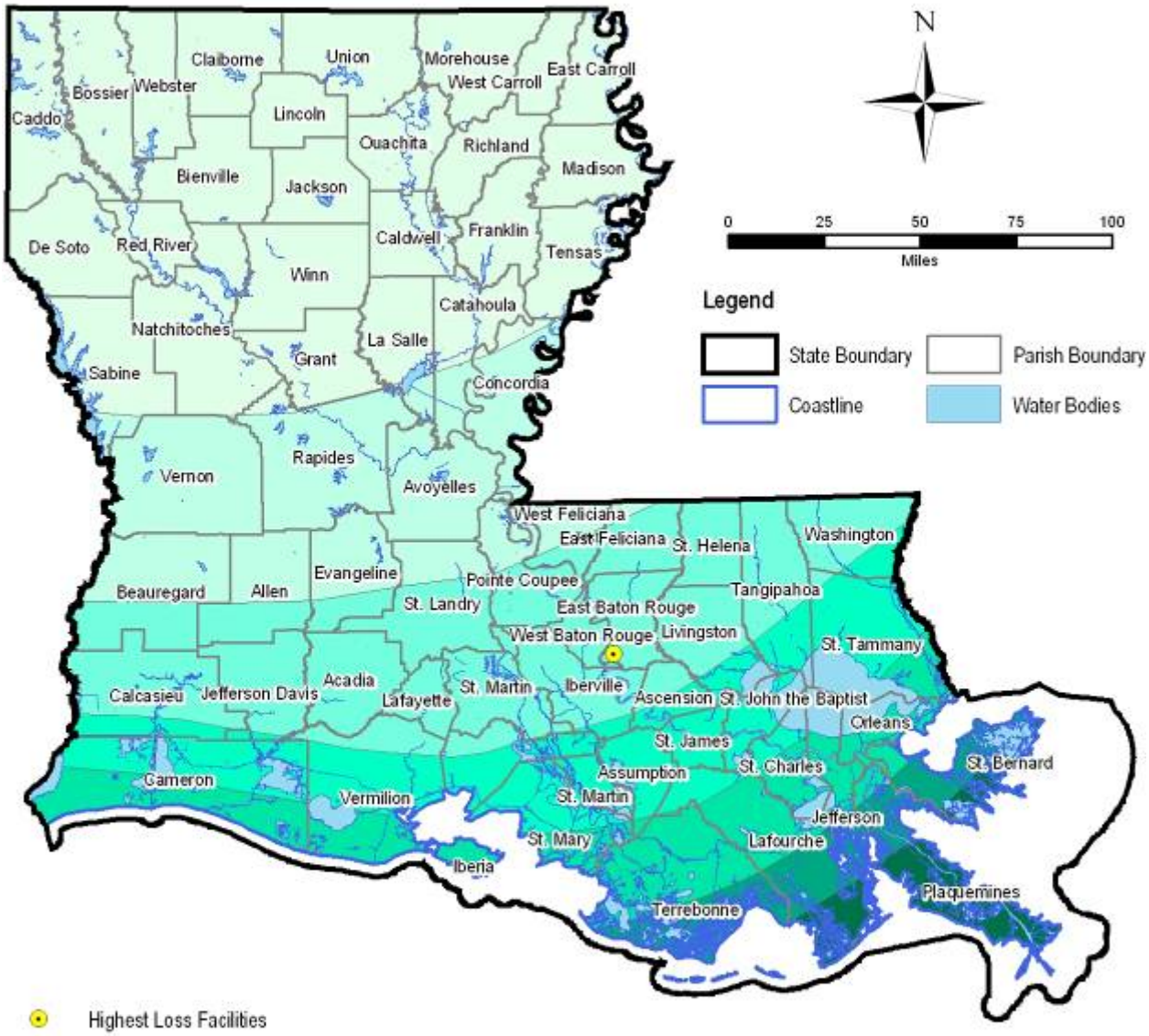
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-37: Loss Estimate - High Winds - Top 10 - Non-Appropriated Requirements



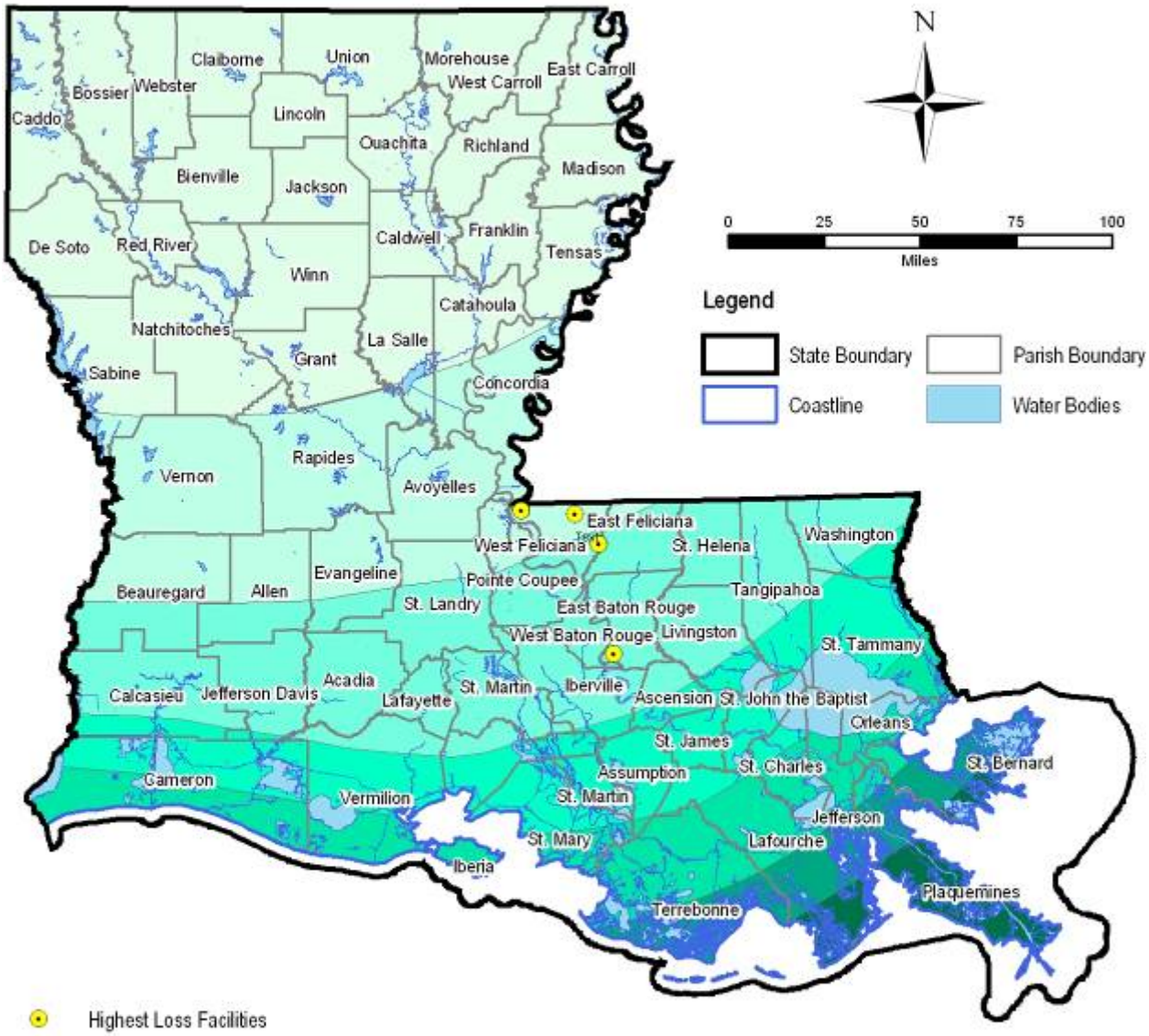
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-38: Loss Estimate - High Winds - Top 10 - Other Requirements



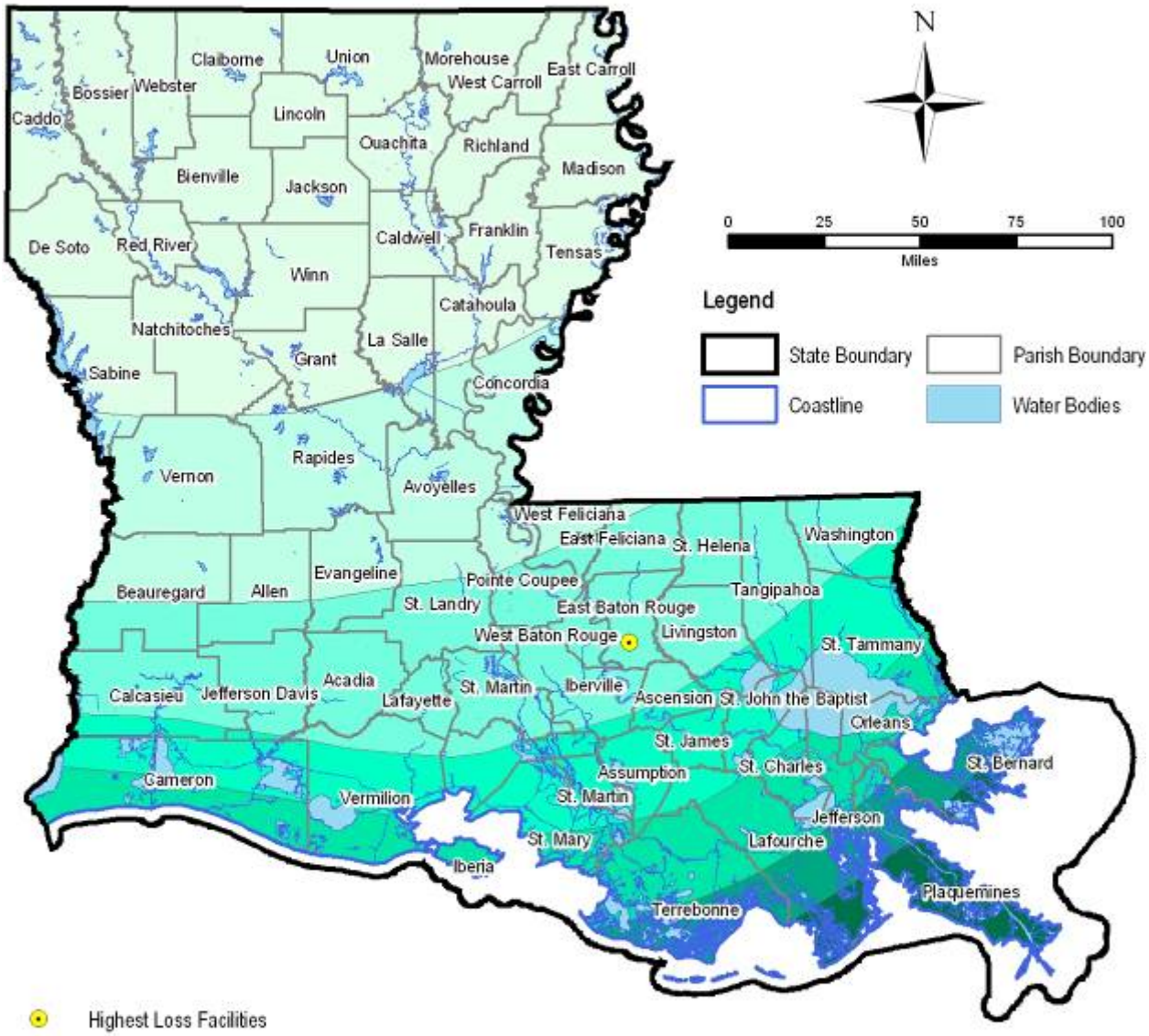
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-39: Loss Estimate - High Winds - Top 10 - Retirement Systems



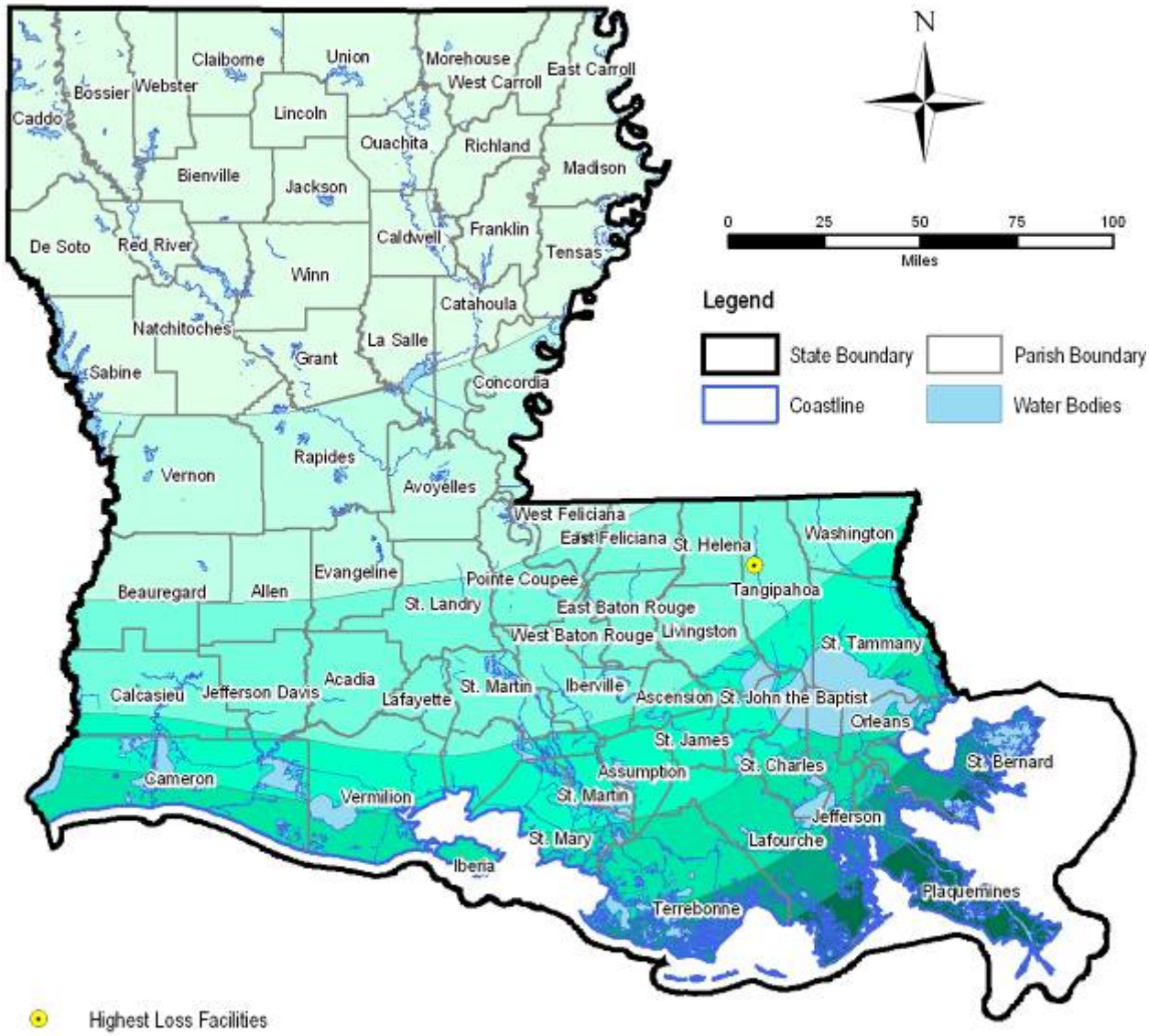
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-40: Loss Estimate - High Winds - Top 10 - Department of Social Services



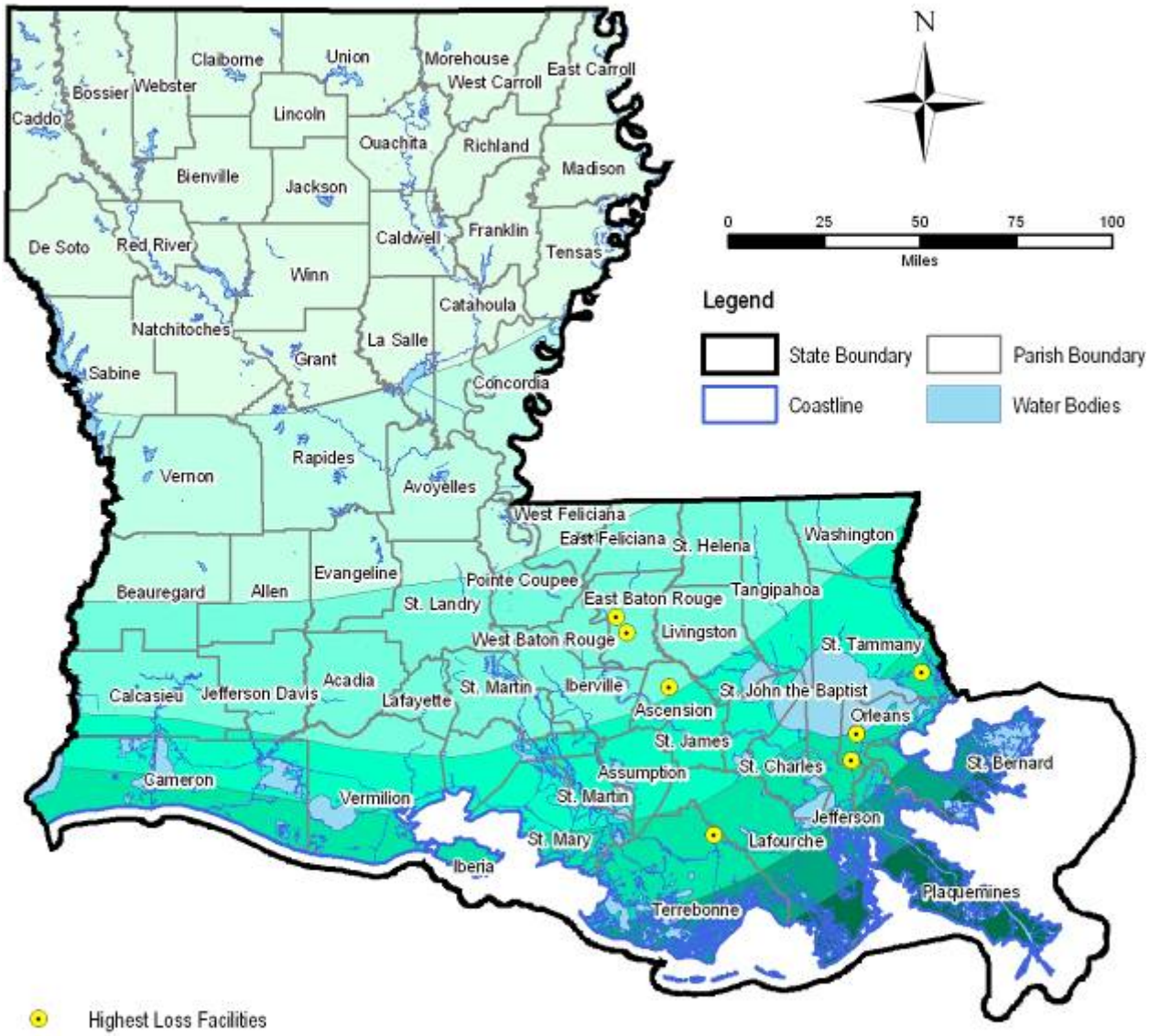
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-41: Loss Estimate - High Winds - Top 10 - Department of Transportation and Development



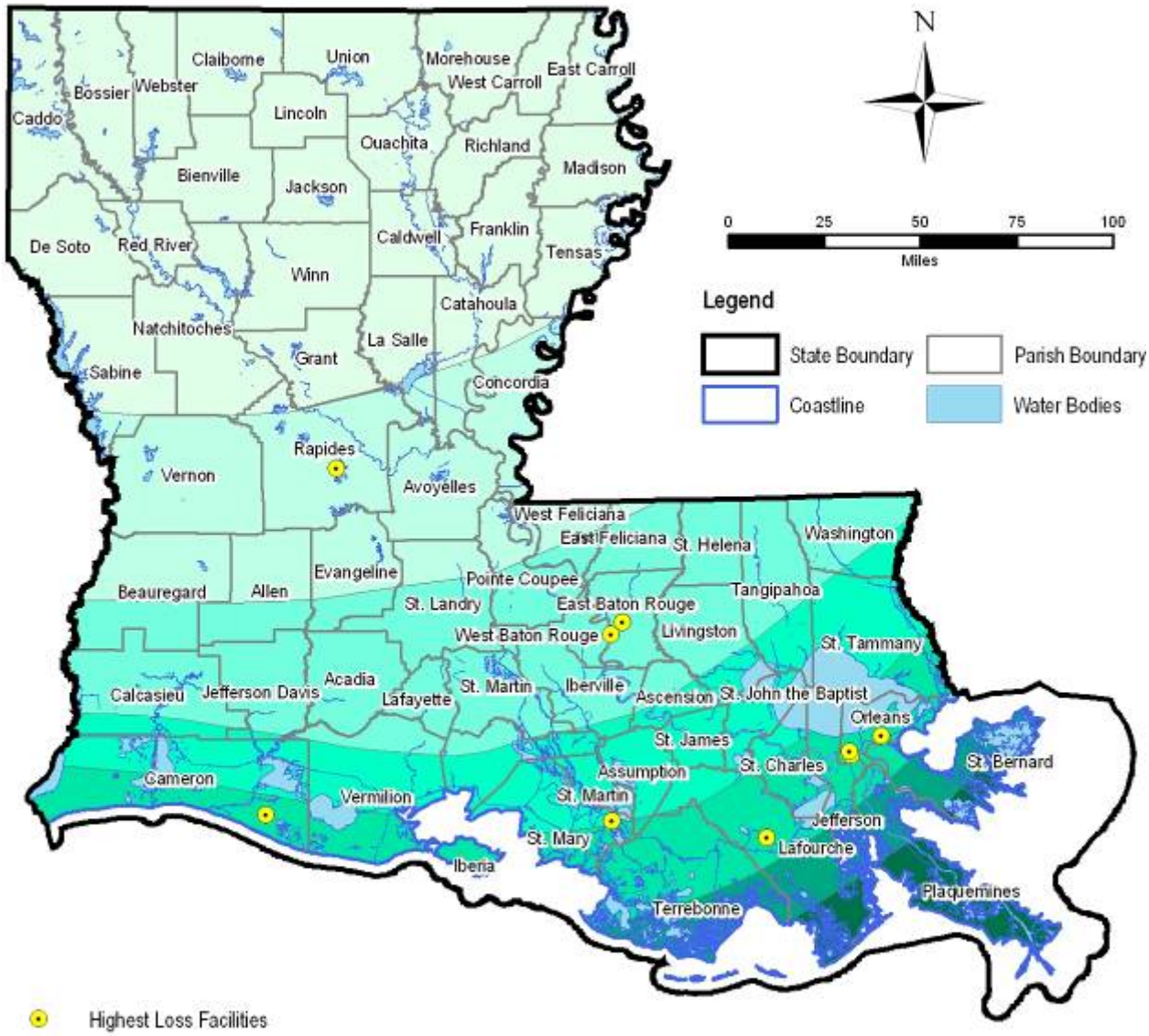
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-42: Loss Estimate - High Winds - Top 10 - Unknown Departments



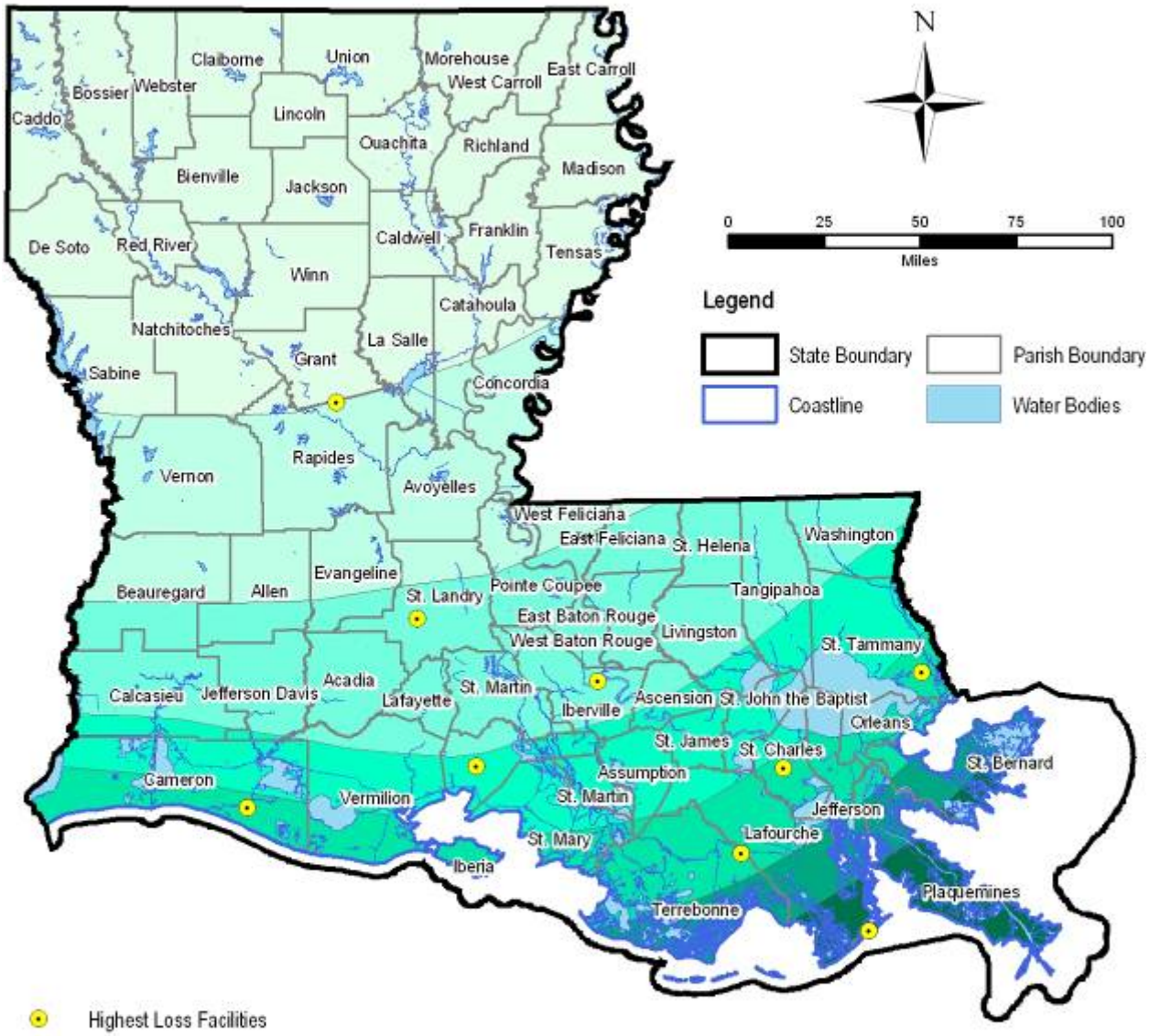
Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

Map F-43: Loss Estimate - High Winds - Top 10 - Department of Wildlife and Fisheries



Source: Louisiana Facility Management Database

Wind Speed

Less than 90 mph	101 - 110 mph	121 - 130 mph	141 - 150 mph
91 - 100 mph	111 - 120 mph	131 - 140 mph	

Source: ASCE Standard 7-02

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